UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/023,712	12/21/2001	Hidehiro Matsuoka	217572US2RD	6800

22850 7590 08/18/2005

OBLON, SPIVAK, MCCLELLAND, MAIER & NEUSTADT, P.C.
1940 DUKE STREET
ALEXANDRIA, VA 22314

EXAMINER	
GHULAMALI, QUTBUDDIN	
ART UNIT	**PAPER NUMBER**
2637	

DATE MAILED: 08/18/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/023,712	MATSUOKA ET AL.	
	Examiner	Art Unit	
	Qutub Ghulamali	2637	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *21 December 2001*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-19* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-19* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *12/21/01, 4/04/02, 4*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Claim Objections

1. Claim 10 is objected to because of the following informalities: Claim 10, line 2, recites "P/S converter". It is suggested that the "P/S" be spelled out at first use. Appropriate correction is required.

Claim Rejections - 35 USC § 112

2. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

3. Claim 18 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 18 recites the limitation "said addition circuit" in line 1. There is insufficient antecedent basis for this limitation in the claim 15.

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

5. Claims 1-7 are rejected under 35 U.S.C. 103(a) as being unpatentable over Alamouti et al (USP 5,933,421) in view of Kai-Kit Wong et al (IEEE Transaction on Communication "Adaptive Antennas at the Mobile and Base Stations in an OFDM/TDMA System").

Regarding claims 1 and 3, Alamouti discloses a receiver using a plurality of antenna elements comprising:

a plurality of Fourier transformation sections (DFT) which are connected to said plurality of antenna elements (antenna 0, antenna 1...antenna 7) and configured to output signals carried on sub-carriers (pilot) orthogonal to each other from signals received by each of said antenna elements (figs. 1.10, 2.2) (col. 15, lines 3-25);

an antenna weight calculation unit which is connected to said Fourier transformation sections and configured to extract the said signals carried on pilot sub-carriers of said sub-carriers from the output signal of said Fourier transformation sections and calculate an antenna weight of each antenna elements corresponding to each of sub-carrier groups, each sub-carrier group includes a plurality of the sub-carriers whose center frequencies are located in the vicinity of the center frequency of one of pilot sub-carrier (col. 15, lines 64-67; col. 16, lines 1-13; col. 17, lines 35-48);

a plurality of weighting units which are connected to said antenna weight calculation unit and said Fourier transformation unit and configured to weight the signals of said sub-carrier groups respectively with the antenna weights as calculated by means of said antenna weight group calculation unit (col. 15, lines 11-19, 48-61). Alamouti however, does not explicitly disclose "an adder circuit which is connected to said weighting units and configured to add together the signals of said sub-carrier groups as weighted with said antenna weights for each of said antenna

elements". Wong in a similar field of endeavor discloses (fig. 2a-b) an adder circuit which is connected to said weighting units and configured to add together the signals of said sub-carrier groups as weighted with said antenna weights for each of said antenna elements (page 196, second column, page 197, first column). It would have been obvious to a person of ordinary skill in the art at the time the invention was made to use a combiner as taught by Wong in the system of Alamouti because it can maximize the estimation of signal noise (interference) and signal to noise ration of the array output signal (symbols).

Regarding claim 2, Alamouti discloses a receiver using a plurality of antenna elements comprising:

a plurality of Fourier transformation sections (DFT)which are connected to said plurality of antenna elements (antenna 0, antenna 1...antenna 7) and configured to output signals carried on sub-carriers (pilot) orthogonal to each other from signals received by each of said antenna elements (figs. 1.10, 2.2) (col. 15, lines 3-25);

a pilot signal extraction unit which intermittently extracts signals carried on pilot sub-carriers having a predetermined center frequencies from the output signals of said parallel-to-serial conversion section (col. 16, lines 22-36);

an antenna weight calculation unit which is connected to said Fourier transformation sections and said pilot signal extraction unit and configured to calculate an antenna weight of each antenna elements corresponding to each of sub-carrier groups by the use of the signals carried on said pilot sub-carriers as extracted by said pilot signal extraction unit, each sub-carrier group includes a plurality of the sub-carriers whose center frequencies are located in the vicinity of the

center frequency of one of pilot sub-carrier (col. 15, lines 64-67; col. 16, lines 1-13; col. 17, lines 35-48);

a plurality of weighting units which are connected to said parallel-to-serial conversion section and said antenna weight group calculation unit and configured to multiply the output signals of said parallel-to-serial conversion section with said antenna weights as calculated by said antenna weight group calculation unit for each of the sub-carrier groups (col. 15, lines 48-61). Alamouti however, does not explicitly disclose a plurality of parallel-to-serial conversion sections and an adder circuit.

Wong in a similar field of endeavor discloses a plurality of parallel-to-serial conversion sections which are connected respectively to said Fourier transformation sections and configured to perform parallel-to-serial conversion of the signals carried on said sub-carriers as Fourier transformed in a time division manner (fig. 1, page 196, columns 1 and 2); and

an adder circuit (fig. 2a-b) which is connected to said weighting units and configured to add together the signals of said sub-carrier groups as weighted with said antenna weights for each of said antenna elements (page 196, second column, page 197, first column). It would have been obvious to a person of ordinary skill in the art at the time the invention was made to use a parallel to serial conversion circuit and combiner as taught by Wong in the system of Alamouti because parallel to serial conversion can provide discrete signal transformation at transmission and an adder circuit because it can maximize the estimation of signal noise (interference) and signal to noise ration of the array output signal (symbols).

With reference to claim 4, Alamouti discloses a method of receiving radio frequency signals comprising:

a step of calculating antenna weights with reference to predetermined pilot sub-carrier signals which are extracted from the received signal as Fourier transformed (col. 15, lines 64-67; col. 16, lines 1-13);

a step of weighting the signals as Fourier transformed with said antenna weights in order that a group of the sub-carrier signals is weighted with common antenna weights as calculated with reference to at least one pilot sub-carrier signals belonging to said group (col. 17, lines 35-48).

Regarding claims 5 and 6, Alamouti discloses a method of receiving radio frequency signals comprising:

a step of intermittently and separately received signals in extracting pilot sub-carrier signals from a serial signal containing a time series data sequence as Fourier transformed (col. 12, lines 55-63);

a step of calculating antenna weights for each of sub-carrier groups with reference to a pilot sub-carrier signal of said pilot sub-carrier signals which belong to said each of sub-carrier group (col. 6, lines 56-67; col. 7, lines 1-7); and

a step of weighting said serial signal containing a time series data sequence by timely switching said antenna weights corresponding to said sub-carrier group (col. 4, lines 57-63).

Regarding claim 7, Alamouti discloses:

an input section (RF) which is configured to receive signals as digitized after received by antenna elements respectively (figs. 2.1, 2.2) (col. 11, lines 55-60);

a pilot signal extraction unit which is connected with said input section and configured to intermittently extract pilot sub-carrier signals from said signals received through said input section (col. 12, lines 55-63; col. 13, lines 20-25);

an antenna weight calculation unit which is connected to said pilot signal extraction unit and configured to calculate an antenna weight of each antenna elements corresponding to each of sub-carrier groups, each sub-carrier group includes a plurality of the sub-carriers whose center frequencies are located in the vicinity of the center frequency of one of said pilot sub-carrier (col. 6, lines 56-67; col. 7, lines 1-7);

a plurality of weighting units which are connected to said antenna weight calculation unit and said antenna elements respectively and configured to weight the signals received by said antenna elements respectively with said antenna weights as calculated by said antenna weight group calculation unit;

a timing controlling unit (synchronization) which is connected to said pilot signal extraction unit and said antenna weight group calculation unit and configured to supply timing signals to said pilot signal extraction unit and said antenna weight group calculation unit (col. 25, lines 35-67; col. 26, lines 1-14).

Alamouti however, does not explicitly disclose an adder circuit.

Wong in a similar field of endeavor discloses an adder circuit (fig. 2a-b) which is connected to said weighting units and configured to add together the signals of said sub-carrier groups as

weighted with said antenna weights for each of said antenna elements (page 196, second column, page 197, first column). It would have been obvious to a person of ordinary skill in the art at the time the invention was made to use an adder circuit as taught by Wong in the circuit of Alamouti, because it can maximize the estimation of signal noise (interference) and signal to noise ration of the array output signal (symbols).

Claim Rejections - 35 USC § 102

6. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

7. Claims 8-12, 15, and 19, are rejected under 35 U.S.C. 102(b) as being anticipated by Alamouti (USP 5,933,421).

Regarding claims 8, 9 and 15, Alamouti discloses:

a plurality of antenna elements which are configured to separately receive OFDM signals as modulated in accordance with said orthogonal frequency division multiplexing modulation (col. 6, lines 56-67; col. 7, lines 1-7);

a plurality of Fourier transformation circuits which are connected respectively to said plurality of antenna elements and configured to perform Fourier transformation of said OFDM signals as received by each of said antenna elements and output signals carried on said sub-carriers (figs. 1.10, 2.2) (col. 15, lines 3-25);

an antenna weight calculation unit which is connected to said Fourier transformation circuits and configured to receive the signals carried on said sub-carriers and calculate antenna weights corresponding respectively to said antenna elements to form an antenna directivity pattern (col. 6, lines 56-67; col. 7, lines 1-7); and

a plurality of weighting units which are connected to said antenna weight calculation unit and said Fourier transformation unit and configured to weight the output signals of said Fourier transformation unit (circuit in parallel see fig. 2.2) corresponding to the OFDM signals received by said antenna elements on the basis of said antenna weights as calculated by means of said antenna weight calculation unit,

wherein the output signals corresponding to a plurality of said sub-carriers are weighted with a common antenna weight for each of said antenna elements (col. 15, lines 48-61; col. 16, lines 22-36).

Regarding claims 10 and 19, Alamouti discloses weighting units and said Fourier transformation circuits are connected through an P/S converter which is configured to convert

the parallel signals output from said Fourier transformation circuits to serial signals and transfer said serial signals to said weighting units in a time division manner (figs. 2.1, 2.2) (col. 9, lines 30-45).

Regarding claim 11, Alamouti discloses said antenna elements and said Fourier transformation circuits are connected through high frequency wave reception circuits which are configured to perform orthogonally demodulation of said OFDM signal as received by said antenna elements and transfer said OFDM signal as orthogonally demodulated to said Fourier transformation circuits (figs. 1, 2.2; col. 6, lines 62-67; col. 11, lines 55-67).

Regarding claim 12, Alamouti discloses said high frequency wave (RF) reception circuits and said Fourier transformation circuits are connected through an A/D converters (ADC) which is configured to convert the analog signals output from said high frequency wave reception circuits to digital signals and transfer said digital signals to said Fourier transformation circuits (DFT) (see fig. 2.2).

Claim Rejections - 35 USC § 103

8. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

9. Claims 13-14, 16, 17, 18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Alamouti et al (USP 5,933,421) in view of Kai-Kit Wong et al (IEEE Transaction on

Communication "Adaptive Antennas at the Mobile and Base Stations in an OFDM/TDMA System").

Regarding claims 13 and 18, Alamouti discloses all of the claimed limitations above, except does not explicitly disclose A/D converters and Fourier transformation circuits are connected through a Serial to Parallel converter. Wong in a similar field of endeavor discloses said A/D converters and said Fourier transformation circuits are connected through an Serial to Parallel (S/P) converter which is configured to convert the serial signals output from said A/D converters to parallel signals and transfer said parallel signal to said Fourier transformation circuits (fig. 1, page 196). It would have been obvious to a person of ordinary skill in the art at the time the invention was made to use a Serial to Parallel converter to connect the A/D converter and said Fourier transformation circuits as taught by Wong in the circuit of Alamouti, because it can maximize the estimation of signal noise (interference) and signal to noise ration of the array output signal (symbols).

Regarding claims 14 and 17, Alamouti discloses all limitation of the claim above except does not explicitly disclose an addition circuit to perform addition operation of the signals (OFDM). Wong in a similar field of endeavor discloses a circuit (addition) connected to said weighting units and configured to perform addition operation of the signals output from said Fourier transformation circuits and correspondingly weighted to form an antenna directivity pattern (page 196, second column, page 197, first column). It would have been obvious to a person of ordinary skill in the art at the time the invention was made to use an adder circuit as taught by Wong in the circuit of Alamouti, because it can maximize the estimation of signal noise (interference) and signal to noise ration of the array output signal (symbols).

Regarding claim 16, Alamouti discloses all limitation of the claim above except does not explicitly disclose optimizing antenna weights calculations. Wong in a similar field of endeavor discloses antenna weight calculation unit calculates said antenna weights by switchingly giving a plurality of sets of the antenna weights to the antenna elements and comparing a plurality of antenna directivity patterns as calculated from the signals on the sub-carriers as output to determine the antenna weights of an optimal one of the antenna directivity patterns (page 199, column 2). Therefore, it would have been obvious to a person of ordinary skill in the art at the time the invention was made to use optimum antenna weights to form antenna directivity patterns as taught by Wong in the circuit of Alamouti because it can facilitate in the formation of antenna directivity patterns in an iterative manner.

Conclusion

10. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

US Patents:

Li et al (USP 5,973,642) discloses adaptive antenna arrays for orthogonal frequency division with co-channel interference.

Obayashi (USP 6,249,249) shows active array antenna system.

11. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Qutub Ghulamali whose telephone number is (571) 272-3014. The examiner can normally be reached on Monday-Friday from 8:00AM - 5:00PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jay Patel can be reached on (571) 272-2988. The fax phone number for the organization where this application or proceeding is assigned is 571.273.8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

QG.
August 17, 2005.

JAY K. PATEL
SUPERVISORY PATENT EXAMINER